

The record for La Manuelita was made on the sugar estate of Mr. Charles J. Eder about 5 miles northwest of Palmyra.

TABLE 2.—Mean monthly precipitation (inches).

| Stations. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Annual. |
|----------------|----------|-----------|--------|--------|------|-------|-------|---------|------------|----------|-----------|-----------|---------|
| Bogota..... | 3.04 | 3.62 | 3.97 | 7.88 | 6.79 | 3.99 | 2.71 | 2.71 | 2.22 | 8.01 | 7.75 | 4.44 | 57.13 |
| La Manuelita.. | 3.19 | 3.10 | 4.16 | 6.09 | 5.37 | 2.92 | 1.50 | 1.49 | 2.98 | 5.81 | 4.72 | 3.20 | 44.59 |
| Medellin..... | 2.16 | 2.52 | 5.27 | 6.93 | 7.76 | 6.61 | 4.13 | 5.12 | 6.42 | 7.38 | 5.87 | 12.68 | 62.83 |

Seasonal distribution.—Table 2 contains the monthly averages for the stations, Bogota, on the high table-land; La Manuelita, in the upper Cauca Valley; and Medellin, the capital of the Department of Antioquia. The latter is the largest of the inhabited departments of the Republic; its capital is situated at the junction of at least four mountain ranges at an elevation of about 5,000 feet. It is an example of those cases where the pause in the wet season is not well marked, there being fairly heavy rains in July and August. La Manuelita at a less elevation and slightly nearer to the Equator has two wet and two dry seasons, although not sharply defined. The rains of Bogota show a slight diminution in July, August, and September and in a less degree in January and February.

Finally, Table 3 gives the monthly amounts for Bogota and Pato mines in Antioquia. The record of the latter is for a single year only, but it illustrates the variable nature of wet and dry seasons. The dry season in the particular year here given was confined to the two months February and March.

TABLE 3.—Monthly precipitation (inches) for Bogota and Pato mines.

| Year. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Annual. |
|--------------------------------------|----------|-----------|--------|--------|-------|-------|-------|---------|------------|----------|-----------|-----------|---------|
| BOGOTA. | | | | | | | | | | | | | |
| 1848 ¹ | ... | ... | ... | ... | 7.80 | 3.07 | 3.19 | 3.23 | 4.76 | 7.80 | 15.75 | 9.61 | ... |
| 1849 ¹ | 5.47 | 3.35 | ... | 3.90 | 12.72 | 8.50 | 4.84 | 4.06 | 6.02 | 1.97 | 10.39 | 7.79 | 74.40 |
| 1850 ¹ | 5.32 | 5.08 | 3.11 | 6.26 | 5.79 | ... | ... | ... | ... | ... | ... | ... | ... |
| 1850 ² | ... | ... | 10.12 | 9.61 | 7.28 | 2.24 | 1.97 | 2.40 | 2.09 | 5.67 | 3.98 | 2.87 | ... |
| 1881 ² | ... | 5.32 | 1.02 | 9.54 | 4.25 | 2.64 | 1.30 | 1.61 | 2.80 | 9.80 | 10.71 | 4.68 | 54.25 |
| 1882 ² | ... | 3.50 | 3.50 | 2.56 | 3.94 | 3.15 | 2.13 | 2.76 | .94 | 5.83 | 5.59 | 1.93 | 35.91 |
| 1883 ² | 4.13 | 2.05 | 1.89 | 2.19 | 4.53 | ... | 2.80 | 1.89 | .79 | 8.11 | 2.30 | 2.17 | 39.35 |
| 1884 ² | 2.95 | 2.44 | 4.25 | 5.94 | 5.47 | 8.03 | 3.54 | 1.06 | 2.20 | 8.46 | ... | ... | ... |
| Means..... | 3.04 | 3.62 | 3.97 | 7.88 | 6.79 | 3.99 | 2.71 | 2.71 | 2.22 | 8.01 | 7.75 | 4.44 | 57.13 |
| PATO MINES, ON RIO NECHE, ANTIOQUIA. | | | | | | | | | | | | | |
| 1913..... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 1914..... | 8.7 | 1.8 | 0.6 | 8.8 | 18.8 | 14.4 | 10.7 | ... | ... | ... | ... | 7.8 | 143.6 |

¹ *Annuaire de la Société Meteorologique de France* 1: 269-272. 1853.

² *International Bulletin Sig. Ser.* 1880-1884.

In the *Industrial and Commercial Handbook of Colombia*¹ Trade Commissioner P. L. Bell has collected considerable information of a nonstatistical character on

¹ Department of Commerce, *Special Agents Series No. 206*, Colombia.

the rainfall of that country which briefly summarized is as follows:

Caribbean coast country.—A tropical low-lying coast region, dry and semiarid from the peninsula of Goajira as far as Santa Marta, with the rainfall and vegetation increasing from Barranquilla and Cartagena until the region of the Atrato River is reached, where extreme tropical conditions prevail and the rainfall is as heavy as anywhere in the Tropics, being equal to that of Panama. * * *

The Santa Marta region receives slightly more moisture than Rio Hacha (to the east in the Goajiro country), but not enough to mature crops, irrigation having to be resorted to in the banana district south of Santa Marta harbor. The average precipitation in this latter region does not exceed 14 inches. The Caribbean coast in the region of Barranquilla and Cartagena receives more rainfall than Santa Marta, but still not sufficient to mature crops very well, there being frequent years of extreme drought lasting from October to May. The annual average precipitation is about 26 inches.

Interior.—Farther south along the ranges of the central Andes, in the region of Medellin, the climate changes. There are two wet and two dry seasons, the former occurring during April, May, and June and during November and December. Still farther south along this range, as at Manizales, elevation 7,000 feet, the seasons and the amount of rainfall, the latter averaging about 60 inches per annum, are the same but the temperature is lower and may be called ideal. * * *

In the Cauca Valley conditions are about the same as for the second zone, with two wet and two dry seasons, the climate being called semitropical and the temperature averaging 76°.

Pacific coast.—Along the Pacific coast and the western slope of the Cordillera and the small northern range of coast hills, rains are incessant and very heavy, equaling the fall in the Atrato region and that of Panama. At the Pacific port of Buenaventura it rains every day, and the annual precipitation is more than 160 inches. This heavy rainfall on the coast diminishes farther south and in the neighborhood of Tumaco is reduced to the normal amount of 60 inches per annum on the average.

METEOROLOGICAL NOTES ON CANTON, CHINA.

By GEORGE D. HUBBARD.

[Oberlin College, Oberlin, Ohio, Apr. 5, 1922.]

The Freeman Meteorological Observatory, founded in 1918, is located on the campus of the Canton Christian College, 23° 06' N., 113° 19' E., about 1,200 feet from the Canton River. This river is subject to tides at Canton, although about 80 miles from the sea. The shelter is 30 feet above mean river level and consists of a 30-foot-square mat shed which has open sides to a height of 3 feet from the ground and a sloping double roof of palm leaves supported on a bamboo frame. In this shelter are the air thermograph, soil thermograph, barograph, and hygrograph, each making continuous records, and the thermometers and psychrometer for current measurements of air temperature and humidity. Outside the shelter are an evaporation pan, a still well, and an anemometer for measurement of evaporation, a standard rain-gauge, and a thermometer suspended 18 inches underground in a bamboo tube.

On the roof of one of the college buildings are a wind vane and an anemometer and electric sunshine recorder, which are connected to a register in the physics laboratory. There is also provided a tide-well with a continuous-record register. Summaries of the daily observations of all the instruments are published monthly in a four-page leaflet which can be had by any service offering a reasonable exchange.

The author has obtained the records for 1919 and 1920 and herewith presents a summary of monthly totals and averages of six or eight of the elements, which is about half of the items covered by the observatory.

| | Monthly precipitation in centimeters. | Number of days without rain. | Average daily evapora- tion in centimeters. | Amount of wind in kilo- meters. Daily aver- age. | Extreme wind velocity in meters per second. | Average humidities by months. | Maximum temperature in each month. De- grees C. | Minimum temperature in each month. De- grees C. |
|-------------------------|--|---------------------------------|--|--|--|----------------------------------|---|---|
| 1919. | | | | | | | | |
| January..... | 1.46 | 22 | 0.22 | 474 | 19.7 | 82 | 27.9 | 3.8 |
| February..... | 10.22 | 9 | .18 | 506 | 21.5 | 83 | 25.2 | 1.4 |
| March..... | 5.22 | 17 | .23 | 449 | 16.1 | 82 | 29.0 | 11.0 |
| April..... | 22.16 | 12 | .39 | 484 | 32.2 | 86 | 32.1 | 12.1 |
| May..... | 10.58 | 17 | .45 | 423 | 22.8 | 82 | 32.2 | 16.3 |
| June..... | 29.70 | 8 | .55 | 397 | 29.5 | 86 | 33.2 | 23.0 |
| July..... | 21.01 | 19 | .63 | 438 | 24.1 | 84 | 34.3 | 25.0 |
| August..... | 23.20 | 18 | .58 | 484 | 29.5 | 79 | 35.4 | 23.4 |
| September..... | 3.84 | 22 | .60 | 364 | 24.1 | 76 | 32.8 | 20.5 |
| October..... | 7.54 | 23 | .47 | 401 | 18.8 | 81 | 31.8 | 12.4 |
| November..... | 7.12 | 23 | .40 | 439 | 15.7 | 71 | 29.4 | 5.4 |
| December..... | 4.11 | 27 | .33 | 529 | 25.0 | 71 | 22.4 | 4.9 |
| Totals and averages. | 146.16 | 217 | .41 | 451 | ----- | 80.7 | 35.4 | 1.4 |
| 1920. | | | | | | | | |
| January..... | 0 | 31 | .30 | 484 | 24.1 | 65.0 | 23.5 | 2.1 |
| February..... | 20.50 | 12 | .16 | 555 | 21.5 | 86.0 | 26.3 | 6.3 |
| March..... | 10.28 | 13 | .22 | 417 | 21.5 | 86.0 | 28.4 | 8.0 |
| April..... | 34.96 | 10 | .30 | 384 | 27.3 | 80.0 | 28.7 | 14.4 |
| May..... | 37.76 | 14 | .40 | 414 | 32.2 | 86.0 | 32.0 | 20.0 |
| June..... | 24.80 | 12 | .53 | 385 | 26.8 | 85.3 | 33.2 | 21.6 |
| July..... | 50.32 | 11 | .60 | 525 | 24.6 | 83.5 | 35.7 | 24.2 |
| August..... | 54.65 | 11 | .47 | 364 | 24.6 | 91.0 | 33.5 | 23.1 |
| September..... | 12.66 | 14 | .51 | 346 | 24.1 | 80.0 | 33.7 | 22.5 |
| October..... | 3.48 | 23 | .35 | 389 | 17.9 | 70.0 | 33.0 | 16.3 |
| November..... | 11.66 | 20 | .36 | 392 | 18.8 | 76.0 | 29.6 | 12.4 |
| December..... | 5.73 | 20 | .21 | 462 | 23.2 | 79.0 | 29.5 | 7.6 |
| Totals and averages. | 272.80 | 191 | .37 | 426 | ----- | 81.1 | ----- | ----- |

For many of the items two years' observations do not seem to be sufficient upon which to base a description of the climate, but many interesting points may be noted. The rainfall for 1920 was almost twice as great as for 1919, and this seems to be due to a larger precipitation in almost every month, to longer rains, and more rain per day. We have no way to ascertain which is nearer the average for Canton. January of the second year had absolutely no rainfall, and of the first year had 1.46 cm., distributed over nine days. There seems to be a definite seasonal distribution of the rainfall. October, November, December, and January had a total of 95 days of no rain in 1919 and of 94 days in 1920, while the four months April, May, June, July had 56 and 47 days with no rain in their respective years.

While many days had only a small fraction of a centimeter of rainfall, several days had a very heavy fall. In 1919, 11 days had over 2.5 cm. and 1920 had 34 similarly rainy days. These days are scattered all through the year from February to November in each case. December and January are the dry months, also the months with no heavy rain. The heaviest one-day precipitation fell on July 19 in the second year, when 26 cm., or over 10 inches, was recorded. No other day in the whole period attained quite half this record. While the more rainy months and all the heavier rains come during the season of the southeast monsoon, yet the rainiest day came when the wind was from the west. Of the eight heaviest rainy days, four had east winds, one north wind, two south winds. These heavy rainy days are frequently preceded and followed, within a day or two, by wind from the same direction with no rainfall.

Although there is a rather distinct rainy and dry season, the sunshine recorder, which operated about 16 months out of the two years, never showed a full day of sunshine. Eleven hours was occasionally exceeded, but usually only a few days in the month had sunshine more than six hours. The summer and early fall seem to be

the sunniest times. One September had 22 days in which the sun shone over six hours. The Octobers had 14 and 16 such days, the Novembers had 8 and 7 such days, and the Decembers, 13 and none. In 1920, February had 24 days with no sunshine, March 20 days and April 10, while July had 23 days with over six hours sunshine and still had over 50 cm. of rainfall. Mornings and evenings banks of stratus clouds are common, and through all the warmer weather the cumulus cloud is very common.

The humidity figures given in the table indicate the subtropical monsoon conditions, and the average relative humidities for the two years are only 0.4 per cent apart, in spite of the fact the more humid year had twice as much rainfall. Only twice in the two years did the humidity for a day fall below 50 per cent. Those were days in December and January. This humidity is determined by averaging three readings, taken at 7, 1, and 6 o'clock. Ten months out of the 24 had at least one day with an average humidity between 50 per cent and 60 per cent, and these are scattered well through the years—January, 2; May, 1; September, 1; October, 2; November, 2; December, 2. Several days carried an average humidity for the day of over 96 per cent. The mean daily evaporations for the two years are 0.41 cm. and 0.37 cm., respectively, although the daily average for February fell to 0.18 and 0.16 cm., respectively, and in July it rose to 0.63 and 0.60 cm., respectively. There is here a reflection of the temperature, but not of the humidity or monsoon wind effect.

The wind direction is apparently the normal monsoon. In October, November, December, January, and February it is very constantly from the north, while in April, May, June, July, and August it is pretty steadily between south and east. While the direction is fairly constant, the velocity varies greatly. The maximum velocities observed run from 15 or 16 meters per second in October and November to 32.2 meters per second in April and May. The instruments have recorded the amount of wind in kilometers per day. Eleven days in the two years have to their credit over 1,000 km. of wind, and one of these exceeded 1,400 km. These days of heavy wind fell two in January, one in February, two in July, three in August, and three in December. The lowest amount of wind recorded was 117 km. on June 28, 1920. On November 9 of the same year none was recorded at all, and the maximum velocity that day was 2.2 m. per second. Such a day in November would be very comfortable, but the one in June must have been as sticky as a glue pot.

The maximum, minimum, and range of temperatures as shown in the above tables are about what would be expected in a subtropical climate. It is earnestly hoped that this excellent piece of work carried on by the college will be continued for many years to come and that the results will have a wide circulation for the observatory is very completely equipped and the observers are careful and competent.

CLIMATIC FEATURES OF SANTOS, BRAZIL.

[Abstracted from report furnished by U. S. Vice Consul Herndon W. Goforth, Santos, Brazil, Jan. 20, 1922.]

Inasmuch as Santos is the greatest coffee port in the world, Brazil's leading export center, and a popular place of residence (population over 100,000), the following notes on the climatic features may be of some interest:

Santos is on the island of São Vicente, immediately off the coast of Brazil, 200 miles southwest of Rio de Janeiro. The chief part of the city is but 7 feet above mean sea level.